Five Points Fuels Reduction Project - Soil Resource Summary

Existing Condition

Soil Productivity

Soils within the Five Points project area are characterized by their influence of volcanic ash, which are a defining characteristic of the Blue Mountains ecoregion. This project has mixed volcanic ash found in drier forest and expansive meadow systems as well as thick volcanic ash caps found in highly productive mixed conifer systems.

Representative soil series within the project area include Klicker, Larabee, Limberjim, and Harl. The Klicker series has minor volcanic ash influences and are often shallow, rocky, and can have steeper slopes. The Larabee series is characterized by mixed volcanic ash and areas that act as an interface between forests and meadows. The Limberjim series represents deep volcanic ash soils that are highly productive and allow for densely forested stands. The Harl series are very deep and well drained soils like the Limberjim series but located on side slopes of plateaus.

Multiple entries over many decades for timber harvest and other purposes have occurred, and residual soil disturbance is widespread in extent. Based on field visits and monitoring units, many of the soils are recovering with the assumption that they were impacted at various levels during previous entries. Since the 1990 Forest Plan, the level of concern for maintaining soil productivity has greatly increased. This increase has been accompanied with implementation of management practices that protect the soil. These changes include the use of excavators instead of dozers for mechanical site preparation, use of designated skid trails, operating when soils are dry or when winter conditions would protect soil productivity, harvester-forwarder systems, and use of slash layers to reduce effects on skid trails. In addition, vegetation management projects are audited for compliance with BMPs and are monitored as specified in the NEPA decision, both of which contribute to better results.

Picture 1 Tie Creek area in an old Patch Clearcut stand

Detrimental soil conditions observed in the project area were primarily compaction and rutting in old skid trails. Other DSCs found were related to user-created or legacy timber harvest systems that have increased from cross-country travel. Existing detrimental soil conditions were surveyed in 30 proposed units with most units meeting regional soil quality standards.

Picture 2 Compacted ash soil with massive and platy structure

Picture 3 Compacted ash soil with massive structure

Picture 4 Rutting within a skid trail

Picture 5 Non-system road

Picture 6 Non-system road

This project has some limited areas with sensitive soils which have been identified and mitigations have been planned to prevent loss of productivity and function. Dry meadows with shallow soils are considered sensitive soil types because of their shallow soil depth and inability to recover from disturbance events. There are dry meadows with shallow soils scattered throughout the project area. These areas are defined as having thin, rocky soils with drought tolerant plants (Johnson and Simon, 1987). These soils have more rock and clay than soils influenced by loess or volcanic ash. When located on concave surfaces, these soils are often saturated until mid to late July. Disturbance tends to disrupt the rock-moss-plant species. Care must be taken to avoid these areas when choosing landing sites and skid trail locations (Soil PDC 4). The Wallowa-Whitman 1990 LRMP Standards and Guidelines specifically identify these soils and require avoidance and mitigation measures to provide protection. Below is a picture of a clay dominated soil in a meadow area.

Thick ash cap soils are also considered a sensitive soil. Volcanic ash has a low bulk density and bearing strength, which enables a high water-holding capacity (Geist and Strickler, 1978; Geist et al., 1989). The low bulk density also increases the potential for rutting and compaction. In these areas, ground based equipment would be carefully managed to prevent ash cap loss and confined to period when soil is dry, frozen, or snow covered (Soil PDC 5). Vegetation will recover quickly reducing erosion, and in the case of pinegrass plant associations, the pinegrass mat helps hold the soil in place. Volcanic ash cap soils often hold an excess of soil moisture either yearlong or on a seasonal basis and have an udic soil moisture regime. Disturbance on these sensitive soils can lead to loss of productivity. Soils with udic soil moisture regimes require PDCs for protection and mitigation (Soil PDC 5). Thick volcanic ash cap soils often found with twin flower/prince's pine or pinegrass understory vegetation was observed throughout the project. Below are pictures of thick volcanic ash observed in typical vegetation types.

Picture 7 Thick volcanic ash with twin flower/prince's pine

Picture 8 Thick volcanic ash with pinegrass

Hydric soils are wetland soils also considered sensitive, they are defined as a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (USDA NRCS, 2018). Hydric soils facilitate and regulate the flow of water between groundwater systems and surface water systems. Biogeochemical cycling is dependent on the combination of aerobic and anaerobic conditions in hydric soils. The capacity of hydric soils to retain water and develop anaerobiosis promotes specific plant communities and unique wildlife habitats. Wetlands are is defined in regulations, 16 U.S.C. Section 3801(a)(27): "as land that has – 1. Has a predominance of hydric soils, 2. Is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions, 3. Under normal circumstances supports a prevalence of such vegetation. For the purposes of FSA [Food Security Act] and any other Act, this term does not include lands in Alaska as identified as having high potential for agricultural development that have a predominance of permafrost soils". These soils have been mapped and will be treated as a wetland according to INFISH and Forest Plan definitions, which will prevent resource damage.

Picture 9 Hydric soil

Low productivity soils have inherent soil properties that lower the soils ability to retain adequate organic matter reservoirs needed for nutrient cycling and maintenance of long-term site productivity. These soil types will have specific protections and mitigations to ensure site productivity is maintained (Soil PDC 16).

Soil Erosion

Most of the slopes are under 30%, have low sediment delivery potential, and low surface runoff. Erosion potential when soils are undisturbed is low and low to moderate erosion potential when soils are disturbed. During field observations, one small area showed signs of head cutting erosion within the drainage where the

category 4 stream has extended higher up the hillslope. Pictures below show head cutting formed naturally or potentially from past activities.

Picture 10 Headcut forming on gentle slope

Picture 11 Extension of category 4 stream

Slope Stability

The geology within the project area is dominated by basic igneous rocks, primarily basalt. Slopes under 30% are stable within the project area whereas steeper slopes are less stable especially shallow rocky slopes with less vegetation root networks. There were no signs of slope instability observed in the field.

Mitigations

Soil Quality Mitigations	
SQ-1 Greater than 20 percent Detrimental Soil Conditions	In areas where **more than 20 percent** detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration must, at a minimum, not exceed the conditions prior to the planned activity and should move towards a net improvement in soil quality (R6 Soil Quality Standards) by rehabilitating landings and used skid trails as needed through de-compacting to bring post-activity DSCs to acceptable levels in each activity area.
SQ-2 Less than 20 percent Detrimental Soil Conditions	In areas where **less than 20 percent** detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 20 percent. In units expected to exceed 20 percent detrimental soil conditions: 1. Rehabilitate landings and used skid trails as needed through de-compacting to bring post-activity DSCs to acceptable levels in each activity area. 2. If de-compacting is not feasible (i.e., shallow, clayey, rocky and/or topographic constraints) restrict harvest activities to winter harvest conditions. 3. If none of the above actions are feasible, then the treatment area should be excluded from mechanical activities.
SQ-3 Seasonal Conditions	Limit equipment operations to frozen, snow-covered or acceptable soil moisture conditions. Limit machine pivots and turns, where possible. During the winter season ground conditions shall meet at least one of the following criteria for machine operations: 1. Six inches of frozen ground, 2. Four inches of frozen ground with one foot of snow, 3. Two feet (>24 inches) or more of snow, 4. One foot (>12 inches) slash mat in combination with one foot of snow, or 5. Soil moisture conditions acceptable for minimizing rutting or puddling of soils Some “watch-out” situations include: 1. Machine break-through begins to occur 2. Equipment tracks sink deeply (half the width of the track) below the soil surface with one or two passes 3. Ruts greater than six inches deep form 4. Mid-day temperatures are forecast to rise above freezing 5. Surface melt occurs over still-frozen subsurface
SQ-4 Shallow Soils	Avoid operating on shallow soils (<25 cm soil depth) and meadows unless over frozen ground/snow. Shallow soils and clayey soils should not be used for temporary roads, skid trails, slash piles, or log landings; unless no other location is practical and there is an existing prism in which case equipment activity should remain within existing prism as much as possible.
SQ-5 Udic Soils	Avoid early summer equipment operations on units with udic moisture regime (moist soils with inherent excess soil moisture either yearlong or on a seasonal basis). If this is not possible or there is evidence of lingering moisture present, operate on a bed of slash maintained at >12 inches to mitigate compaction and rutting.
SQ-6 Soil mitigations during ground-	Ground-based equipment should not operate on sustained slopes exceeding 35%. Prioritize areas of slopes greater than 35% as leave areas within units. Designated skid trails should be spaced on average 100 feet apart, and the trails should average no more than 12 feet in width. Closer spacing due to complex terrain will be with Timber Sale

based operations	administrator approval. Existing skid trails will be used as much as possible. 1. If equipment must leave designated trails for operational purposes, no more than two passes over any piece of ground is permitted. 2. Ensure that water control structures (water bars or slash surfacing, as approved by the Sale Administrator or COR) are installed and maintained on skid trails that have gradients of 10 percent or more; Ensure erosion control structures are stabilized and working effectively before spring runoff. When cut to length harvest systems are used, maintain an appropriate slash mat of at least 12" when possible during operations to prevent equipment weight from altering soil bulk density and causing displacement of effective ground cover. If unable to maintain an appropriate slash mat, impacts are expected to be the same as tractor logging.
SQ-7 Shallow and Nutrient Poor Soils	Whole-tree yarding methods should be avoided in shallow soils (<25cm), nutrient-poor (granitic soil, glacial outwash sands, many coarse-textured soils) soils or in sensitive areas. If not possible, backhaul slash and redistribute on skid trails to an average depth of 6 inches within the harvest area, and extend the period for reentry to allow more time for nutrient inputs.
SQ-8 Soil mitigations for slopes >35%	Use advanced logging systems where treatment is planned for continuous slopes greater than 35%. Advanced logging systems may include a variety of techniques including, but not limited to, cable yarding or other advanced logging systems where adequate protection against soil compaction and displacement can be demonstrated. 1. Use directional hand falling of trees and winching on slopes greater than 35% that cannot be reached by harvesting equipment from designated skid trails, as much as possible. Leading end suspension should be implemented when cabling or skidding material. 2. Skid trails or yarding corridors on slopes greater than 35% used by the purchaser should be reclaimed by applying appropriate erosion control measures such as the placement of effective ground cover in conjunction with, or in place of, water bars for rehabilitation.
SQ-9 Slope Instability & Mass Movement	Signs of slope instability and mass movement include cracks in soil, tilted or bent trees, increased spring activity or newly wet ground, hummocky or uneven terrain, sunken or broken roadbeds, and/or a recent sag pond has formed that isn't human created. If visual evidence of landslides appears inside or near proposed management activities, treatment will be avoided as appropriate, to ensure potential slope failure is mitigated.
SQ-10 Organic matter mitigation	Strive to maintain fine organic matter (commonly referred to as the duff layer) over at least 65 percent of an activity area following both harvest and post-harvest operations. Keep fine organic matter disturbance to a minimum if the potential natural plant community on site is not capable of producing fine organic matter over 65 percent of the area (Regional Soil Quality Guidelines / FSH 2090.11).
SQ-11 Soil erosion mitigations	Prior to a large autumn precipitation event, ensure necessary water control structures are installed and maintained on skid trails over 10% slope after all ground-disturbing activities. Ensure erosion control structures are stabilized and working effectively and ensure that effective ground cover is left. 1. In areas of general disturbance in ash soils, the top layer (A Horizon) should be pulled back over any disturbed surface to prevent permanent loss of productivity. (Pull berms back over disturbed surfaces) 2. After completion of land management activities, the minimum effective ground cover (EGC) within each activity area within disturbed areas shall be in place to prevent erosion from exceeding background erosion rates for each of the four established erosion hazard

<table>
<tr><td></td><td>classes: low, medium, high or very high (table below). Effective ground cover is defined as the basal area of perennial vegetation, plus duff, litter, and coarse fragments (greater than 2mm sizes), including tree crowns and shrubs that are in direct contact with the ground.

<table>
<tr><th rowspan="2">Erosion Hazard Class</th><th colspan="2">Minimum Effective Ground Cover</th></tr>
<tr><th>1st Year</th><th>2nd Year</th></tr>
<tr><td>Low</td><td>20-30%</td><td>30-40%</td></tr>
<tr><td>Medium</td><td>30-45%</td><td>40-60%</td></tr>
<tr><td>High</td><td>45-60%</td><td>60-75%</td></tr>
<tr><td>Very High</td><td>60-90%</td><td>75-90%</td></tr>
</table>
</td></tr>
<tr><td>SQ-12
Soil rehabilitation</td><td>In areas where de-compacting is prescribed, de-compact to a depth sufficient to ameliorate the presence of detrimental soil compaction (usually between 2 and 12 inches). Discontinue de-compacting where large rocks are continually brought to the soil surface. If a change in soil color is noticed by the operator, operate at a shallower depth that prevents topsoil and subsoil from mixing. Skid trails requiring rehab on slopes > 30% should use erosion control methods that prevent channelized flow. Picking up ripping tines periodically down the slope.

1. Effective ground cover for all de-compacting treatments should take advantage of harvest slash. If no suitable organic material is available, then weed free straw or other equivalent erosion control measures should be applied on slopes exceeding 15%, adjacent to waterways and ditches (within 100 feet), prior to seasons ending precipitation event. See BMP AqEco-2 for additional information.</td></tr>
<tr><td>SQ-13
Roads</td><td>Non-system or legacy road templates will be used for temporary roads to the greatest extent possible. Creation of new temporary roads will be minimized. Where needed, locate to fit the terrain, and follow natural contours and minimize adverse effects to soil, water quality and riparian resources. Locate roads to fit the terrain and follow natural contours. Placement of new temporary roads should be on deep soils, as possible and avoid temporary roads on clay-dominated soils. Any new temporary roads within RHCAs will be approved by a hydrologist and sale administrator prior to constructing.
Temporary road mitigation measures include:
Locate temporary roads on flat terrain and benches where possible to reduce cut/fill construction and sedimentation risks
Provide adequate drainage through proper location, out sloping and installing water bars as appropriate
Install suitable storm water and erosion control measures (water bars, out slope) to stabilize disturbed areas and waterways before seasonal shutdown of project operations or when severe or successive storms are expected.
Upon completion of use, rehabilitate temporary roads by removing any culverts, decompacting the road surface and covering all disturbed areas with slash. Rehab may also include re-contouring the natural slope profile as possible, masking entrances, and seeding with native plant seed to promote effective ground cover.
Avoid burning of slash and organic material incorporated into road rehabilitation during prescribed fire activities.</td></tr>
<tr><td>SQ-14
Fire and Fuels</td><td>Grapple pile operations would use the same skid trails as harvest operations where possible. Mechanical fuel operations would adhere to ground-based equipment PDCs mentioned above.

Where feasible, pile slash on sites already disturbed by logging activities (e.g. skid trails, landings, and roads) to minimize additional detrimental soil impacts from burning. Avoid locating slash piles on shallow soils (<25cm). Piling slash should not occur above or below culverts or drainages to</td></tr>
</table>

	prevent sediment delivery. If piling fuels near a culvert or drainage, pile fuels away from the culvert or drainage high water flow. Limit hand pile size to less than 50 square feet to reduce organic horizon loss and limit soil heating. Pile burning when duff is moist or wet can reduce organic matter loss and soil heating. When using a boom-mounted equipment, operator shall plan off-trail travel paths to make full use of the machine's capability (e.g., using the full boom reach of the machine) to limit ground disturbance and minimize the number of off-trail passes. Reclaim all machine-built fire lines by redistributing displaced topsoil and unburned woody debris over the disturbed surface as needed after burn has been completed. Install water bars on fire lines using the following guideline: 5-15% slope every 150 feet, 16-35% slope every 40 feet, 36-60% slope every 30 feet, and >60% slope every 15 feet. On slopes less than 15%, water bars may not be needed if adequate amounts of slash are available. Slash and organic material that must be incorporated into road rehabilitation should not be intentionally burned.
SQ-15 Low productivity soil mitigation	Adequate amounts of slash should be left within the unit to retain fine organic matter on low productivity soils with inherently lower ability to retain adequate organic matter reservoirs. If Regional Soil Quality Standards and Guidelines are unable to be met because the stand is incapable of producing enough slash, all slash should be left untreated.

Environmental Consequences

Soil Productivity

Ground disturbing activities would be laid out to occupy less than 20 percent of each activity unit including system roads. System roads in this project area average 3.4 percent of the analysis area. Landings occur approximately every 10 acres of an activity area and occupy a space of approximately ¼ acre. Acres of skid trails are assumed to be 1/10th of the unit and only half are considered to produce new DSCs. The other half are assumed to be on old skid trails. New skid trail DSCs are calculated by taking half of the estimated skid acres and dividing that value by the unit acres. For tractor harvest, that number will always be 5%. In addition to using designated skid trails and landings, there would be potential to reduce soil effects further by limiting equipment operation on skid trails to when soils are dry (below field capacity, i.e. below optimum water content) (McNabb, 2001; Startsev et al., 2001). Rutting and puddling are most often associated with logging on wet soils (Williamson et al., 2000). Most summer logging would occur when soils are drier than field capacity. By operating on low soil moisture conditions, we have the potential to reduce the amount of detrimental disturbance from ground-based operations (Soil PDC 3). Limiting machine pivots and turns, where possible reduces the amount of soil displacement and compaction that occurs (Soil PDC 3). Ground-based equipment operations (commercial thinning and mechanical fuels) will follow Best Management Practices (BMPs) and the above Project Design Criteria and after completion of activities should not exceed any Region 6 Soil Quality Standards. Some units are anticipated to exceed 20% Detrimental Soil Condition (DSC) threshold and will adhere to Soil PDC 2 (Units 2, 7, 17, 21, 32, 65, 45A, 9A).

The proposed action will ensure that soil productivity will move toward a net improvement in soil quality. Additional protection of the soil resource would be afforded by having ground-based operations only when soils are dry, snow covered, or frozen. Piling and burning generates minimal detrimental disturbance. Hand treatments would not be expected to result in any additional detrimental impacts.

Hand piles will be kept small to retain the organic horizon and limit soil heating. These hand piles should also be burned when duff moisture is moist or wet which will help reduce organic matter loss. The material that remains in all the activity areas would provide an active, microorganism-rich organic layer on the soil surface.

Non-system or legacy road templates will be used for temporary roads to the greatest extent possible. The creation of new temporary roads will be minimized. Placement of new temporary roads will be on deep soils, as possible and will avoid shallow and clay-dominated soils. Upon completion of use, all temporary roads will be rehabbed by removing any culverts, decompacting the road surface and covering all disturbed areas with slash. Rehab may also include re-contouring the natural slope profile as possible, masking entrances, and seeding with native plant seed to promote effective ground cover.

Soil Erosion

Most soils within this project area have low to moderate soil erosion hazard when disturbed. Erosion mitigations are expected to keep soil erosion within background levels following ground disturbing activities (Soil PDC 11).

Soil Stability

Slopes are stable within the project area. Areas with potential instability have been identified and were removed from proposed activity areas. If signs of instability are found Soil PDC 9 will be implemented. Most slopes are less than 30 percent, which greatly reduces the risk of mass failures. The occurrence of any mass failure activity as a result of implementation of project activities is unlikely.

/s/ Mary Young *2/18/2021*

Mary Young Date

Wallowa-Whitman Forest Soil Scientist